Forensics and CBRN incidents

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Mission

NFI provides high quality **forensic services**

with **state-of-the-art technology and science**

on behalf of **clients**
Customers

National

PROSECUTION
POLICE
Magistrates

Government Agencies
for example:
- MoD
- Secret Services
- Competition Authority
- Customs
- Tax Service
- Integration and Naturalisation Service

International

International Courts
- International Criminal Court
- Former Yugoslavia
- Sierra Leone
- Libanon

United Nations

Intl. Forensic Institutes
Forensic Disciplines

- Pathology (cause of death)
- Medicine (manner of death)
- Pediatrics
- Anthropology
- Toxicology
Human Biological Traces

Forensic Disciplines

- Trace Investigation
- DNA typing
- Hair examination
Forensic Disciplines

- Open / Closed Systems
- Cybercrime
- Speech and Audio
- Image Analysis and Biometry
- Dactyloscopy
- Documents, Printers
- Handwriting
- KECIDA
Physics and Chemistry

Forensic Disciplines

- Fire Examination
- Explosions and Explosives
- Toolmarks
- Traffic Accidents
- Weapons and Ammunition
- Environmental Forensics
Forensic Disciplines

- Drugs Analysis
- Drugs Profiling
- Illicit Production
Forensic Disciplines

- Element Analysis
- Chemical Profiling
- Glass, Paint, Tape
- Gun Shot Residue
- Fibers and Textile
- Non-Human DNA
Interdisciplinary Product and Services

- Micro Invasive Traumas
- DVI
- Non Human DNA – Drugs
- IEDs
Mobile Forensic Services

- Assistance at the Crime Scene
  - Latest developments in trace collection
  - Forensic Archeology
  - Blood Pattern Analysis
  - Digital Visualisation (3D scans)
Forensic Incident Response Team

- 7x24 response at calamities
- C B R N / E forensic response
CBRN program
2008 - 2013
Terroristic attacks Madrid and London

many victims
great damage
many first aid assistance organizations
Terroristic attack Beirut

- fire brigade
- first aid assistance
- rescue workers
Features of a calamity/CBRN-e crime scene

• magnitude of the calamity
  * extensive scene of crime
  * many rescuers that should cooperate
  * alignment with emergency units

• conditions on a CBRN-E crime scene
  * presence of contamination sources and contaminated materials
  * protection of staff and environment

CBRN-e incident: an incident where chemical, biological, radiological and nuclear agents might have been used, these threats cannot be excluded in case of terrorist attacks and do need attention.
A. Risk assessment of the scene of crime. Collection of forensic evidence material at a extensive scene of crime, when necessary personal protection means, such as a gas suit with gas masks.

B. The investigation of contaminated evidence material should either be done under specific conditions or the material should be decontaminated.

C. Forensic investigations on CBRN-E agents
a. Methods for safe operation at a crime scene that is contaminated with chemical, biological, radiologic or nuclear agents.

b. Methods for searching, selecting, collecting of evidence material at a CBRN-E crime scene. Registration and packaging of traces and trace carriers.

c. Being ready by practising with other emergency units

d. Providing a knowledge network for CBRN-E.
a. Developing methods to investigate (with CBRN-E agents) contaminated trace carriers and methods to sample classic forensic traces (such as fingerprints, DNA etc.).

b. Identification methods for up to 500 victims in case of a CBRN-E attack by DNA-analysis and/or anthropological methods.
Measure C

isolation (extracting from a matrix) and/or identification of CBRN-E agents (in cooperation with TNO and RIVM)

Screening of human tissue and environment samples on toxic substances (including possible terroistic chemical agents) and when possible profiling these substances.

Investigation methods to determine the origin and composition of the used agents (using new technologies for source determination e.g. genome analysis, developing reference databases, IRMS for bacteria traces and explosives)
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### A. Collecting evidence at crime scene
- CBRN-Front Office:
  - documentation CS
  - development and testing decontaminating agents
  - on site forensics on suspect related exhibits (3 D’s)
- Operating procedures for CBRN contaminated CS (safety)
- Sampling B-agents
- PPE training
- Securing digital data under PPE conditions

### B. Forensic Investigations on CBRN contaminated exhibits
- Transport C(BRN) contaminated exhibits
- Forensic Awareness
- Advice: working under PPE conditions

### C. Forensic investigation on CBRN agents
- Farmacokinetics C-agents
- Tox-screening project
- Identification B-agents
- Contaminated Human Remains (Toxicologie / Pathologie / TNO)
- Cooperation program (NF/ TNO)

### Additional
- Education program R-agents
- Inventarisation/protocolling for forensics on R-contaminated exhibits (FCT)
Program support

Risc inventory and evaluation assessment
* preparedness for possible contamination riscs

Communication plan
* in- and external communication for the program
* propagation and implementation of the developed methods and protocols
CBRNE - Program

Disaster Victim Identification

Education and Training

Forensic Responds at Crime Scene

Biological Agents

Forensic Anthropology

Explosive impact at micro level

Chemical Agents

Radioactive and Nuclear Agents

Explosives
Decontamination and DNA investigation on contaminated traces
DNA extraction and PCR at the Crime Scene
Rapid Identification of large amounts of victims (e.g. SNPs)

New methods for age determination of victims
DNA profiles of 500 people (Napoleon)
Identification process (2-6 Months)
Cooperation with Riken on SNPs (Japan)
Anthropologic DVI

Age determination (TCA)
Within 48 hours
Reproducible

Tooth Cementum Annulation (< 20 micrometer)

Tooth prepared in Resin
Education and training

- NFI CBRN/E forensic response team
- Forensic awareness training first responders
- CBRN/E courses
Biological Agents

Detection and Securing Biological Traces
  SOPs
  DNA-Extraction of pathogens at the Crime Scene
  Securing Biological traces from victims

Determination of Origin of Agents
Bio terrorism and forensics

Collecting evidence
Decontamination
Micro array screening
DNA sequencing
Bio molecules (MS)
Radioactive and Nuclear Agents

SOP for conventional traces collection under RN-conditions

SOP for RN-contaminated trace collection
Explosives

Non-invasive detection of explosives at crime scene (NID-ex)
  UV-vis, SPME-GC-MS, Mobile FT-IR, sniffers

Post blast trace collection (BO-ex)
  Databases
  Modeling of explosion behavior
  Persistence of post blast explosive trace material

Impurity Profiling of organic explosives (IP-ex)
  GC-MS, LI-MS
Forensic Investigation at CBRNE CS

Incident Response Team
Forensic Decontamination
Conventional Traces

Technology
- Wireless Remote Camera
- 3D/IR/Gamma Robot
- Forensic Helmet
- Thermal and multi-spectral cameras
...
Wide range of toxic chemicals

Organic
  Pesticides, Tear gases, Metabolites

Elements
  Arsenic, Mercury, Lead

Anions
  Cyanide, Sulfide, Azide

Technology
  GC-MS
  LC-MS
  Orbitrap MS
  ICP-MS
  ...
Chemical Agents

Screening toxic traces in human material
   Orbitrap, LC-MS-MS, Ion chromatography, ICP-MS

Identification of toxins
   TOF-MS-MS, LC-MS-MS, GC-MS-MS, Ion Chromatography and ICP-MS

Profiling chemical warfare agents
   Research project in collaboration with TNO
      Matching agents with production facility and base chemicals
Profiling chemical warfare agents

- Synthesis of chemical warfare agents (VX, sulphur mustard gas and sarin)

- Correlation synthesis route and unique by-products or characteristic ratio of by-products

- VX and sulphur mustard gas could be detected for several weeks after applying on different materials (rubber, wood and textile)
NFI – Academy and Field Lab
NFI Fieldlab
Practice the Experience
Forensic Fieldlab?

- education and training
- development of operating procedures
- reconstructions
- experiments in ‘safe’ environment
- scenario testing and development
- serious gaming (ref.: CSI The Hague)
Facilities

Lecture and briefing rooms
Mock court
Practice laboratories
Forensic visualization, 3D-practice space
Blood stain pattern analysis room

Simulated Realistic Crime Scenes
(trains, subways, buildings, etc.)
A/V-equipment, camera’s, spot and stage illumination
Imitation of weather conditions
(day light, night, smoke and wind)
Education

• Forensic awareness for first responders
• CBRNe crime scene courses for forensic investigators
• Safety and security training for crime scene investigators
• General criminalistics for judges, prosecutors and lawyers
• DNA statistics and interpretation for judges and prosecutors
• Court training for forensic experts
Training and exercise

NFI CBRN/E forensic response team
HazMat training
Skills training
Decontamination training
NFI CBRN/E forensic response team

- 20 forensic experts (7 different disciplines)
- Trained to investigate a contaminated incident scene
- Minimum of 6 training sessions per year
- Large scale training with first responders
Forensic Investigation at CBRNE CS

Incident Response Team
Forensic Decontamination
Conventional Traces

Technology
- Wireless Remote Camera
- 3D/IR/Gamma Robot
- Forensic Helmet
- Thermal and multi-spectral cameras

...
Training forensics for contaminated crime scenes

Consult police/public prosecutor

Purpose of investigation

Available information

Action plan

Tasks

Equipment

Safety
Equipment: what do you need?
Safety and monitoring

Chemical
- Chempro 100i
- Miniwarn
- Dräger tubes

Radiologic/Nuclear
- GR-100N
- InSpector 1000
Forensic investigation on contaminated CS

Examples

- Forensic reconnaissance
- Secure an item (e.g. mobile phone)
- Swap a DNA-sample
- Sampling liquids
Packing items/samples on IC

Double packing:
- bottle and bag
- Two bags

Size is limited
Decontamination
Incident in industrial furnace
Two operators died in furnace
Forensic investigation

Cause of accident: phosphine and lack of oxygen

Samples of furnace and electrodes
More information on
The Netherlands Forensic Institute

www.forensicinstitute.nl
Thank you.
Questions?